

**What is claimed is:**

- 1                     1.       A process for injection molding a hollow plastic tubular  
2       article comprising the steps of:  
3                     (a)       injecting a quantity of plastic material into a mold cavity  
4       to at least substantially fill said mold cavity, the mold cavity having a  
5       substantially cone-shaped inlet portion, an elongated central portion and an exit  
6       portion;  
7                     (b)       injecting pressurized gas into the plastic material in the  
8       mold cavity;  
9                     (c)       holding the pressure of the gas and plastic in the mold  
10      cavity for a predetermined amount of time; and  
11                    (d)       allowing a portion of the plastic material in the mold  
12      cavity to be expelled into at least one secondary cavity coupled to the mold  
13      cavity.
- 1                     2.       The process as set forth in claim 1 further comprising the  
2       steps of:  
3                     (e)       permitting the plastic material to solidify;  
4                     (f)       exhausting the gas from the mold cavity; and  
5                     (g)       removing the plastic article from the mold.
- 1                     3.       The process as set forth in claim 1 wherein said cone-  
2       shaped portion has an apex and said gas is injected into the plastic material at  
3       said apex.
- 1                     4.       The process as set forth in claim 1 further comprising the  
2       step of holding constant the plastic material injection pressure in the mold  
3       cavity for a predetermined period of time prior to the injection of gas into the  
4       plastic material.
- 1                     5.       The process as set forth in claim 1 wherein said plastic  
2       material is injected into the mold cavity from an injection molding machine  
3       with a barrel and nozzle, said method further comprising the step of allowing a

4 portion of the plastic material in the mold to be expelled back into the barrel of  
5 the injection molding machine.

1 6. The process as set forth in claim 1 wherein said exit  
2 portion comprises a second substantially cone-shaped portion, said cone-shaped  
3 exit portion having an apex and said expulsion of plastic material from the mold  
4 cavity into the secondary cavity occurs through said apex.

1 7. The process as set forth in claim 1 further calculating the  
2 volume of said at least one secondary cavity in order to allow expulsion of a  
3 predetermined amount of plastic material from the mold cavity.

1 8. The process as set forth in claim 1 wherein the step of  
2 allowing a portion of the plastic material in the mold to be expelled comprises  
3 opening a valve member in a conduit connecting the mold cavity with the  
4 secondary cavity.

1 9. The process as set forth in claim 1 wherein the plastic  
2 material is injected into the mold cavity at said cone-shaped inlet portion and  
3 enters the mold cavity along the outer surfaces thereof.

1 10. The process as set forth in claim 9 further comprising a  
2 ring gate mechanism for injecting the plastic material into said cone-shaped  
3 inlet portion.

1 ~~11.~~ A process for injection molding a hollow plastic tubular  
2 article comprising the steps of:

3 (a) injecting a quantity of plastic material to fill or  
4 substantially fill a mold cavity, the mold cavity having a first substantially cone-  
5 shaped inlet portion, an elongated central portion and an exit portion;

6 (b) injecting pressurized gas into the plastic material in the  
7 mold cavity;

8 (c) holding the pressure of the gas and plastic in the mold  
9 cavity for a predetermined amount of time;

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10 (d) allowing a portion of the plastic material in the mold  
11 cavity to be expelled into at least one secondary cavity coupled to the mold  
12 cavity;

13 (e) permitting the plastic material to solidify;

14 (f) exhausting the gas from the mold cavity;

15 (g) removing the tubular-shaped plastic article from the  
16 mold; and

17 (h) trimming at least one end of the article to form a tubular  
18 article of substantially constant cross-section.

1 12. The process as set forth in claim 11 wherein said cone-  
2 shaped inlet portion has an apex and said gas is injected into the plastic material  
3 in said apex.

1 13. The process as set forth in claim 11 further comprising  
2 the step of holding constant the plastic material injection pressure in the mold  
3 cavity for a predetermined period of time prior to the injection of gas into the  
4 plastic material.

1 14. The process as set forth in claim 11 wherein said plastic  
2 material is injected into the mold cavity from an injection molding machine  
3 with a barrel and nozzle, said method further comprising the step of allowing a  
4 portion of the plastic material in the mold to be expelled back into the barrel of  
5 the injection molding machine.

1 15. The process as set forth in claim 11 wherein said exit  
2 portion comprises a substantially cone-shaped portion, said cone-shaped exit  
3 portion having an apex and said expulsion of plastic material from the mold  
4 cavity in the secondary cavity occurs through said apex.

1 16. The process as set forth in claim 11 further calculating  
2 the volume of said at least one secondary cavity in order to allow expulsion of a  
3 predetermined amount of plastic material from the mold cavity.

1                   17.     The process as set forth in claim 11 wherein the step of  
2     allowing a portion of the plastic material in the mold to be expelled comprises  
3     opening a valve member in a conduit connecting the mold cavity with the  
4     secondary cavity.

1                   ~~18.~~    A process for injection molding a hollow tubular plastic  
2     article utilizing an injection molding machine with a barrel and nozzle and a  
3     mold with a mold cavity therein, the mold cavity having a substantially cone-  
4     shaped inlet portion, an elongated central portion and an exit portion, said  
5     method comprising the steps of:

6                   (a)     injecting a quantity of plastic material into said cone-  
7     shaped inlet portion of the mold cavity from the injection molding machine;

8                   (b)     injecting pressurized gas into the plastic material in the  
9     mold cavity; and

10                  (c)     allowing a first portion of the plastic material in the mold  
11     cavity to be expelled back into the barrel of the injection molding machine.

1                   19.     The process as set forth in claim 18 further comprising  
2     the step of holding the constant pressure of the gas and plastic material in the  
3     mold cavity for a predetermined amount of time before said first portion of the  
4     plastic material is expelled back into the injection molding machine.

1                   20.     The process as set forth in claim 18 wherein a  
2     predetermined amount of plastic material is expelled back into the injection  
3     molding machine.

1                   21.     The process as set forth in claim 18 wherein the gas is  
2     injected into the plastic material from said exit portion.

1                   22.     The process as set forth in claim 18 wherein the plastic  
2     material is injected into the mold cavity at said cone-shaped inlet portion and  
3     enters the mold cavity along the outer surfaces thereof.

1                   23.     The process as set forth in claim 22 further comprising a  
2 ring gate mechanism for injecting the plastic material into said cone-shaped  
3 inlet portion.

1                   24.     The process as set forth in claim 18 wherein the step of  
2 allowing a first portion of the plastic material in the mold to be expelled back  
3 into the barrel of the injection molding machine comprises opening a shut-off  
4 valve member positioned between said mold cavity and said barrel.

1                   25.     The process as set forth in claim 24 wherein said valve  
2 member is included as part of the nozzle.